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ANÁLISE DA MAGNITUDE DAS ASSIMETRIAS POSTURAIS EM CRIANÇAS E JOVENS FUTEBOLISTAS

ANALYSIS OF POSTURAL ASYMMETRIES MAGNITUDE IN YOUTH SOCCER PLAYERS

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RESUMO

Introdução: As assimetrias posturais estão relacionadas a diferentes tipos de lesões. Com isso, o controlo postural pode prever problemas dor ou ruturas musculares. Além disso, tarefas desportivas específicas de cada modalidade conduzem à hipersolicitação muscular e desenvolver assimetrias de força. Assim, práticas esportivas como o futebol podem explicar algumas assimetrias posturais.

Objetivo: O objetivo deste estudo foi comparar as assimetrias posturais por nivel competitivo em jovens praticantes de futebol.

Amostra: As assimetrias foram avaliadas com recurso à fotogrametria em 47 sujeitos dos escalões sub 11, 13, 15 e 17 (13,02 ± 2,51 anos de idade). Dez jogadores competiam na equipa Sub-11, 10 na Sub-13, 12 na Sub-15 e 15 na Sub-17 em competições locais.

Métodos: As assimetrias foram avaliadas com recurso à técnica de fotogrametria (software SAPo). Foram capturadas três fotografias com uma câmera digital nos planos frontal e sagital. Os sujeitos estavam na posição ortostática e a câmera a 3 metros de distância e 0,7 metros de altura à frente do sujeito.

Resultados: Foram verificadas diferenças estatisticamente significativas nos maléolos laterais e nas vértebras C7-L1 no plano frontal. Também se identificaram diferenças significativas na coluna vertebral na vista lateral direita do plano sagital. No plano frontal, a magnitude das assimetrias verticais dos maléolos laterais difere entre os jogadores sub-11 e sub-13 ($t = 3,687$; $p = 0,019$) e sub-11 e sub-17 ($t = 0,960$; $p = 0,018$). As vértebras C7-L1 também apresentaram diferenças entre os níveis competitivos de Sub-11 e Sub-15 ($F = 19.058$; $p = 0,006$). As assimetrias posturais tendem a aumentar de acordo com o nível competitivo.

Conclusão: A magnitude das assimetrias tende a aumentar ao longo do tempo, sendo maiores nos jogadores mais velhos do que nos mais novos.

Palavras-chave: Magnitude. Assimetrias. Postura. Jovens. Futebol.

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ANALYSIS OF POSTURAL ASYMMETRIES IN YOUTH SOCCER PLAYERS

ABSTRACT

Introduction: Postural asymmetries are related with different types of injuries. Upon that, postural control may predict further problems as pain events or muscular ruptures. Moreover, sports specific tasks may increase muscular hypersolicitation and develop strength asymmetries. Thus, sports practice such as soccer may explain some postural asymmetries.

Objective: The aim of this study was to compare the body asymmetries across competitive level in young soccer players.

Sample: Postural asymmetries were assessed by photogrammetry in 47 young players from U-11, U-13, U-15 and U-17 teams (13.02 ± 2.51 years).Ten players compete in the U11 team, 10 in the U13, 12 in the U15 and 15 in the U17 at local competitions.

Method: Postural asymmetries were evaluated with photogrammetry technique (SAPo software). Three pictures were taken with a digital camera in the frontal and sagittal planes. The subjects were in the orthostatic position and the camera at 3 meters of distance and 0.7 meters of high in front of the subject

Results: Statistical differences cross competitive level, were identified in the lateral malleoli, and C7-L1 vertebras in the frontal plan. There were also statistical differences in vertebral coloumn in the right view of sagittal plan. In the frontal plan, lateral malleoli vertical asymmetries magnitude, differ between U11 and U13 players ($t = 3.687$; $p = 0.019$) and U11 and U17 ($t = 0.960$; $p = 0.018$). C7-L1 vertebras also presented differences between U11 and U15 competitive levels ($F = 19.058$; $p = 0.006$). The postural asymmetries are prone to increase with competitive levels.

Conclusions: The asymmetries magnitude is prone to increase over time, being higher in older players than younger counterparts.

Keywords: Magnitude. Asymmetries. Posture. Youth; Soccer.

INTRODUCTION

Played by 240 millions of people over the world, soccer is an intermittent sport characterized by several specific actions [1] and strength is a key-factor in multiple accelerations performed over a match [2], with periods of high and low intensity. One of the major concerns in sportive agents is the possible injuries that may probably occur over a season [3], founded a negative correlation between the injuries days and the team success. In Euro 2004, 13 of the 15 injuries in the championship affected the teams that didn't reach the semi-finals. Epidemiologic studies report 60% of the young soccer player's injuries are muscle tensions [4,5]. However, these types of injuries causes are not completely studied, and it is convenient to better understand, for example the role that postural changes play in these kinds of injuries.

The muscular group overuse seems to be a risk factor for postural misalignments, and these ones are currently related to muscle injuries. The kinetic chains imbalance due the muscular groups overuse would generate a new tension in a different body parts, sustaining the reports that some postural asymmetries are related with another one's. E.g., a shoulders asymmetry is related with hip asymmetry contributing for other possible injuries. These could be explained by the ground up and top down theories. Ground up theory supports that a misalignment in an upper body region is predicted by another one in a lower body region. The top down theory explains that a lower body asymmetry is predicted by another one in the upper body region [6].

The correct posture aims to minimize the joints stress, avoiding body misalignments that will impair the mechanics and physiologic efficiency. Sports may induce or prevent the misalignments in body segments with alterations in strength, range of motion, balance and motor coordination [7,8,9] and postural changes are related to pain, injuries and poor performances [10]. However, Watson [11] observed that only 26.5% of the soccer, rugby and American football preserved the spine alignment. The author also related shoulder symmetry, back asymmetry, scapula's abduction, kyphosis, lordosis and scoliosis with back injuries, and these one plays an important role in soccer player's performance. Razo, et al., reports that the arches of feet are related with chronic injuries or micro traumas Watson [10].

Postural asymmetries seem to be related withinjuries incidence [10-13]. Thus, it is important to evaluate and control the postural asymmetries intending to prevent the injuries incidence on each sports modality [10,11]. The magnitude control allows predicting the evolution of the asymmetries and the repercussions it may have in a long time period [13]. Moreover, some equipment's such as insoles [14] have been used to prevent injuries and diminish postural asymmetries [14, 15].

To date, there is a lack of research about the postural alignment in different sports modalities. Upon that, there is a need to understand the postural profile in youth soccer players.

OBJECTIVES

The aim of this study was to analyse the magnitude misalignments of the young soccer players by competitive level, intending to find any statistical difference across competitive levels.

METHODS

The sample of this study was composed by forty-seven young Portuguese soccer players (13.02 ± 2.51 years) from a north of Portugal regional team, all with player's assent and, parental and coaches consent. The sample of the present study had a mass of 53.57 (± 14.38) and height of 1.58 m (± 0.12). Ten players compete in the U11 team, 10 in the U13, 12 in the U15 and 15 in the U17 at local competitions. However, the player's position were not controlled due the sample size. The evaluations took place at the Instituto Politécnico de Bragança (Bragança, Portugal) laboratory. A health and exercise specialist evaluator made the evaluations. The evaluations were made during an off-training day and at the afternoon. The players were asked to use underwear cloths or swimsuit. For this study the parents, coaches, guardians and athletes gave their consent and all procedures were in accordance to Helsinki Declaration for human research.

Segmental alignment was assessed by a photogrammetry technique (SAPo, v. 0.086, Sao Paulo, Brazil). Three pictures were taken with a digital camera (Casio Exilim Zoom ex z1000, Shangai, China) in the frontal (anterior and posterior) and right lateral view, with the subject in the orthostatic position in a 3 meters of distance and 0.7 meters of high in front of the subject(Figure 1). These procedures have been used in different studies assessing postural asymmetries for descriptive and associative studies [12,13].

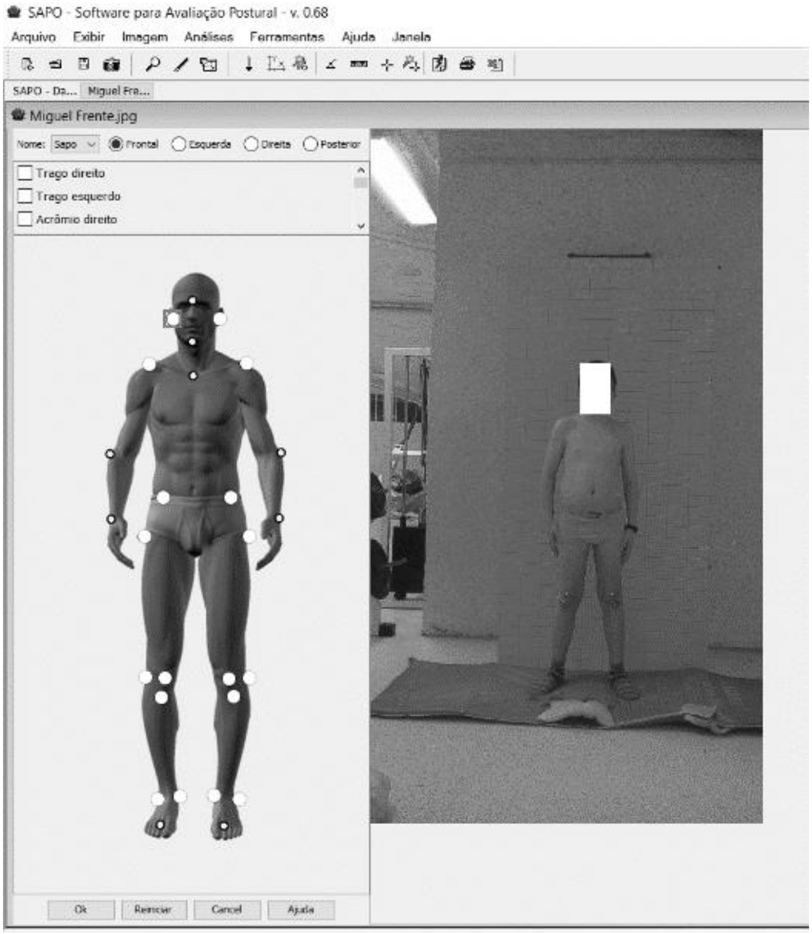

Figure 1. Photographic record (left) and postural analysis in SAPo software at the anterior view of frontal plane.

Styrofoam markers (2.5cm diameter), were placed on the main anatomical landmarks: ears lobules, shoulder acromion's, antero-superior iliac spines, femoral trochanters, patellae, tibia tuberosity's, knee joint line, leg medial line and the lateral and medial malleoli and in spine the C7, T3, T7, T11, L1 and L5 vertebras [12]. The asymmetries magnitude were obtained in centimetres, between the differences of the demarked points (ICC = 1.00; $p<0.001$). Table 1 summarizes the dependent variables selected.

Table 1. Anatomical landmarks plan and view, and the variables abbreviation and description.

Plan/View	Abbreviation	Description
Frontal Plan/Anterior View (FPA)	FPA-DF-EL	Ear lobules vertical misalignment.
	FPA -DF-AC	Shoulder acromion's vertical misalignment.
	FPA -DF-IS	Iliac spines vertical misalignment.
	FPA -DF-FT	Femoral trochanters vertical misalignment.
	FPA -DF-KJL	Knee joint line vertical misalignment.
	FPA -DF-PMP	Patellae vertical misalignment.
	FPA -DF-TT	Tibia tuberosity's vertical misalignment.
	FPA -DF-LM	Lateral malleoli vertical misalignment.
	FPA -DF-MM	Medial malleoli vertical misalignment.
Frontal Plan/ Posterior View (FPP)	FPP-DF-AIE	Scapula's inferior angle vertical misalignment.
	FPP-DF-C7-T3	C7-T3 horizontal misalignment.
	FPP-DF-T3-T7	T3-T7 horizontal misalignment.
	FPP-DF-T7-T11	T7-T11 horizontal misalignment.
	FPP-DF-T3-T11	T3-T11 horizontal misalignment.
	FPP-DF-T11-L1	T11-L1 horizontal misalignment.
	FPP-DF-C7-L1	C7-L1 horizontal misalignment.
	FPP-DF-L1-L5	L1-L5 horizontal misalignment.
	FPP-DF-LMP	Leg medial line vertical misalignment.
Sagital Plan/ Right Lateral View (SPRL)	SPRL-DF-C7-T3	C7-T3 horizontal misalignment.
	SPRL -DF-T3-T7	T3-T7 horizontal misalignment.
	SPRL-DF-T7-T11	T7-T11 horizontal misalignment.
	SPRL-DF-T3-T11	T3-T11 horizontal misalignment.
	SPRL-DF-T11-L1	T11-L1 horizontal misalignment.
	SPRL-DF-C7-L1	C7-L1 horizontal misalignment.
	SPRL-DF-L1-L5	L1-L5 horizontal misalignment.

Normality and homoscedasticity assumptions were analysed with Kolmogorov-Smirnov and Levene tests, respectively. One-Way ANOVA with Tukey post-hoc parametric tests were acceded for differences cross competitive levels and noun parametric tests Kruskall-Wallys for differences between groups and Mann-Whitney for comparison between groups. Significant statistical differences were considered for a $p < 0.05$.

RESULTS

The sample height, mass and body mass index are presented in table 2 for the total sample and by competitive level.

Table 2. Means and standard deviation for age, height, mass and body mass index (BMI).

Competitive Level:	U-11 (N=10)	U-13 (N=10)	U-15 (N=12)	U-17 (N=15)
Variables	$\bar{x}$(± SD)	$\bar{x}$(± SD)	$\bar{x}$(± SD)	$\bar{x}$(± SD)
Age	9.00 (±0.00)	12.1(±0.54)	13.92(±0.86)	15.60 (±0.49)
Height (m)	1.39(±5.47)	1.55(±7.99)	1.64(±7.09)	1.69 (±4.13)
Body mass (kg)	35.80 (±7.07)	50.3 (±8.19)	53.833 (±7.40)	67.40 (±10.81)
BMI (Kg/m^2)	18.48 (±2.82)	20.85 (±2.36)	20.09 (±2.22)	23.52 (±3.55)

The main results for this research are depicted in tables 3 and 4. Under 11 the postural asymmetries ranged from 0.17 to 5.93 centimetres in the different variables. However, the vertical asymmetries ranged from 0.17 to 1.66 centimetres. The maximum asymmetry magnitude occurs in spine, in the right view of sagittal plane. The under 13 soccer players, the postural alterations ranged from 0 to 5.37 centimetres. The maximum asymmetry was also observed in spine as the under 11 players. Under 15 ranged from 0.15 to 6.48, and the under 17 from 0.14 to 9.41 centimetres. Under 15 and 17, the higher values were observed in the spine at the right view of sagittal plan.

In the frontal plan, lateral malleoli asymmetries magnitude, presented vertical differences cross competitive levels between U11 and U13 players ($t = 3.687$; $p = 0.019$) and U11 and U17 ($t = 0.960$; $p = 0.018$). C7-L1 vertebras also presented differences between U11 and U15 competitive levels ($F = 19.058$; $p = 0.006$).

Table 3. Means and standard deviation for postural asymmetries magnitude in the different competitive levels.

Competitive Level:	**U11**	**U13**	**U15**	**U17**
Variables	$\bar{x}$(± DP)	$\bar{x}(\pm \mathrm{DP})$	$\bar{x}(\pm \mathrm{DP})$	$\bar{x}(\pm \mathrm{DP})$
FPA-DF-EL	0.17 (± 0.26)	0 (± 0)	0.15 (± 0.26)	0.14 (± 0.19)
FPA -DF-AC	0.73 (± 0.75)	1.03 (± 1.10)	0.62 (± 0.56)	0.69 (± 0.87)
FPA -DF-IS	0.36 (± 0.42)	0.57 (± 0.56)	0.93 (± 1.45)	0.27 (± 0.26)
FPA -DF-FT	0.60 (± 0.64)	1.02 (± 1.01)	0.79 (± 0.81)	0.40 (± 0.60)
FPA -DF-KJL	1.41 (± 1.16)	1.15 (± 0.85)	1.36 (± 1.26)	0.83 (± 0.86)
FPA -DF-PMP	1.55 (± 0.96)	1.27 (± 1.09)	0.91 (± 0.61)	1.14 (± 0.65)
FPA -DF-TT	1.50 (± 0.71)	0.95 (± 0.95)	0.87 (± 0.55)	1.27 (± 0.41)
FPA -DF-LM	1.66 (± 0.89)	0.73 (± 0.73)	0.96 (± 0.81)	0.70 (± 0.50)
FPA -DF-MM	1.01 (± 0.58)	0.46 (± 0.56)	0.73 (± 0.66)	0.63 (± 0.42)
FPP-DF-AIE	0.18 (± 0.27)	1.08 (± 1.21)	0.32 (± 0.43)	0.51 (± 0.59)
FPP-DF-C7-T3	0.49 (± 0.61)	0.45 (± 0.55)	0.47 (± 0.48)	0.37 (± 0.46)
FPP-DF-T3-T7	0.49 (± 0.61)	0.93 (± 0.78)	0.85 (± 0.47)	1.15 (± 0.71)
FPP-DF-T7-T11	0.54 (± 1.00)	0.62 (± 0.51)	0.48 (± 0.56)	0.63 (± 0.52)
FPP-DF-T3-T11	0.49 (± 0.46)	0.47 (± 0.43)	0.68 (± 0.49)	0.67 (± 0.59)
FPP-DF-T11-L1	0.58 (± 0.56)	0.85 (± 0.69)	0.59 (± 0.42)	0.23 (± 0.32)
FPP-DF-C7-L1	1.16 (± 0.79)	0.75 (± 0.72)	0.22 (± 0.39)	0.63 (± 0.81)
FPP-DF-L1-L5	0.50 (± 0.53)	0.54 (± 0.68)	0.71 (± 0.84)	0.94 (± 0.62)
FPP-DF-LMP	0.71 (± 1.16)	0.73 (± 0.79)	0.53 (± 0.40)	0.75 (± 0.81)
SPRL-DF-C7-T3	5.19 (± 1.47)	4.68 (± 1.48)	6.44 (± 1.85)	7.15 (± 1.00)
SPRL -DF-T3-T7	2.19 (± 1.22)	2.96 (± 1.02)	6.48 (± 3.64)	9.41 (± 2.57)
SPRL-DF-T7-T11	1.74 (± 1.09)	1.67 (± 0.94)	2.81 (± 1.52)	3.43 (± 1.40)
SPRL-DF-T3-T11	1.37 (± 0.89)	1.67 (± 1.33)	2.14 (± 1.36)	3.19 (± 1.94)
SPRL-DF-T11-L1	0.48 (± 0.45)	1.08 (± 0.79)	1.77 (± 1.45)	0.95 (± 0.66)
SPRL-DF-C7-L1	1.97 (± 0.94)	2.51 (± 0.78)	2.09 (± 1.86)	0.95 (± 0.78)
SPRL-DF-L1-L5	5.93 (± 2.40)	5.37 (± 2.22)	1.98 (± 1.38)	1.25 (± 0.89)

Table 4. Statistical differences between groups for the postural asymmetry's magnitude.

Test Type	Variable	t/F	p
Parametric	FPA -DF-LM	3.687	0.019
	SPRL-DF-C7-T3	6.658	0.001
	SPRL -DF-T3-T7	20.866	<0.001
	SPRL-DF-T7-T11	4.889	0.005
	SPRL-DF-T3-T11	3.371	0.027
	SPRL-DF-T11-L1	3.410	0.026
	SPRL-DF-C7-L1	3.789	0.017
	SPRL-DF-L1-L5	19.847	<0.001
Noun Parametric	FPP-DF-C7-L1	11.180	0.011

On SAPo software, it is possible to compare the anthropometric model with each subject. A visual comparison between the aligned model and the participant is possible to be done. Thus, scoliosis, kyphosis and lordosis are possible to identify in the posterior vew of the frontal plane and lateral views of sagittal plane. On anterior view of frontal plane (Figure 1) and posterior view (figure 2, left panel) it is possible to identify the vertical asymmetries (i.e: shoulders vertical asymmetries and knees articular line vertical asymmetry).

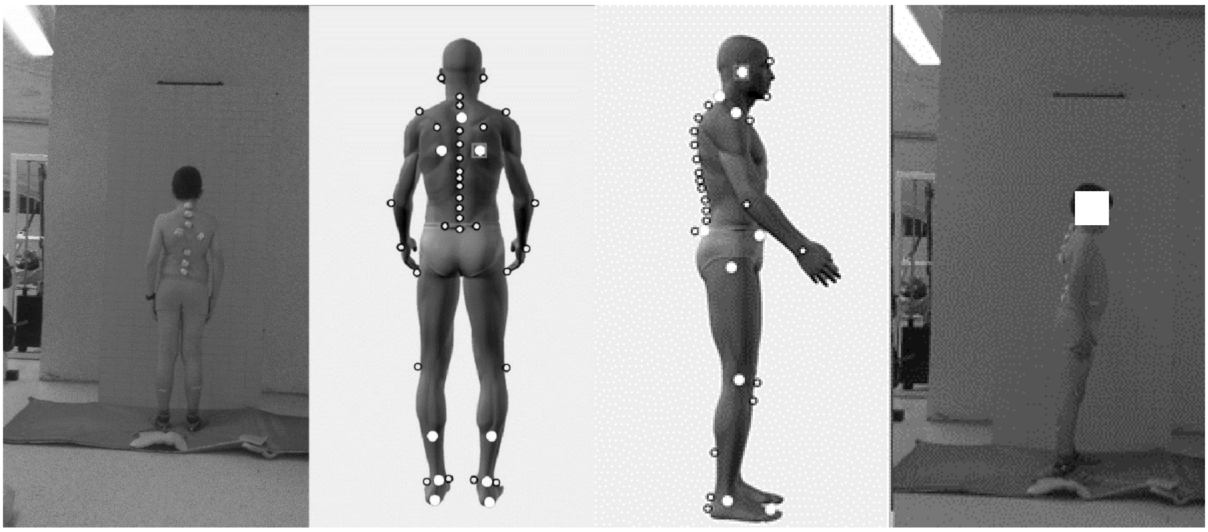

Figure 2. Participant and SAPo anthropometric model in the posterior view of the frontal plane (left panel) and SAPo anthropometric model and participant right lateral view of sagittal plane (right panel).

DISCUSSION

The aim of this study was to identify the statistical differences in postural asymmetries magnitude cross competitive level in youth soccer players. In the anterior view of frontal plane asymmetries were founded in lateral malleoli, in the right lateral view of sagittal plane the differences were observed in the C3-T7, T3-T7, T7-T11, T11-L1, C7-L1 and L1-L5 vertebras and in the posterior view of the frontal plane statistical differences were observed between C7-L1 vertebras.

Photogrammetry is a valid and reproductive method to evaluate postural differences. It shows quantitative and precise results. Comparing to visual scan this only allows qualitative evaluation [16,17,18]. The gold- tandard for body asymmetries is x-ray, however it is an expensive procedure and photogrammetry present reasonably similar results [18,19].

The major of asymmetries magnitude seams to maintain. However, differences between groups allows to observe a tendency for magnitude increase over competitive levels, older the team, greater the asymmetry magnitude. This could be explained by the repeatability technics and specific soccer actions during the time, contributing for strength and range of motion imbalances. Those imbalances are risk factors for postural asymmetries. So, the gestures repeatability in young soccer players that had already postural asymmetries could increase or reduce the asymmetry magnitude [7,8,9].

The lateral malleoli differences cross competitive level could be explained by the repetitive use of inadequate shoes. It also can be explained by the Ground Up and Top Down theories, in these ones, a lower body asymmetry can be predicted by another one in upper body due the kinetic chains compensation [6].

The asymmetries magnitude statistical differences cross competitive level in the C3-T7, T3-T7, T7-T11, T11-L1, C7-L1 and L1-L5 vertebras in the right lateral view, could be explained by the definition of the spine curves during the growth. Kyphotic, and lordosis curves tend to increase during the human development. These spine curves could be also predicted by the presence of other postural asymmetries, sustained by the Ground Up and Top Down biomechanics inaccuracies theories [6].

The scoliosis presence in the posterior view of frontal plan, could be explained by the other asymmetries, once spine injuries are frequently affected by asymmetries. Watson[10] related shoulder symmetry, back asymmetry, scapula's abduction, kyphosis, lordosis and scoliosis with back injuries. New injuries are by itself a risk factor for inadequate postures adoption, increasing the risk of asymmetries incidence such as scoliosis.

The major differences occur between the U11 and U13 with U15 and U17 competitive levels. U11 and U13 soccer it's different than U15 and U17. U11 and U13 players participate in seven versus seven in a reduced field area and U15 and U17 compete in eleven versus eleven players in a real soccer field area. The number of players and the field are by itself new requirements for the young soccer players. Physical contacts and demands tend to increase, explained by the field dimension from 7x7 to 11x11 players. Thus, the transition from U7 to U11 teams is by itself a risk factor for asymmetries magnitude [20,21]. However, once human growth is not symmetrical, it can also explain the asymmetries cross competitive levels. Bass et al. [22], founded that bone growth is not uniform and it's affected by bone type, regions and bone surfaces, these findings were obtained in a study with 109 girls during puberty. They have also founded that in pre-pubertal age, growth is disproportional greater in legs and, in adolescence, it is greater in trunk region.

The identified postural asymmetries in the posterior and anterior views of the frontal plane are most of the times associated with scoliosis events [10]. Soccer players with scoliosis are prone to increase the muscles tension during exercise. Moreover, the movement hypersolicitations such as shooting or passing may result in easier pain events and muscular inflammation [7,8,9]. Upon that, increasing the strength levels may help to prevent muscular inflammation due the postural asymmetries mechanical and physiological stress.

The asymmetries that are possible to observe in the right and lateral view of the sagittal plane are realted with kyphosis and lordosis asymmetries [10]. That said, most of the lordosis are associated with low back pain events [10]. Moreover, kyphosis are prone to increase the shoulders region muscular stress. Again, the hypersolicitation of soccer specific tasks such as shooting and passing may lead to an easier muscle inflammation and pain events[7,8,9]. Increasing the muscular strength levels has been appointed as an effective way to prevent pain and muscular inflammation events.

The present study has the following limitations: (i) only 47 youth players were recruited for this research and all the players were from the same team; (ii) the muscular strength were not assessed; (iii) the physical fitness were not assessed. Thus, as future reseach it is recommended to assess: (i) comparison of postural asymmetries across different teams; (ii) assess the effect of physical fitness on postural asymmetries; (iii) perform a longitudinal analysis of postural asymmetries.

Based on this study, coaches and sports scientists can assess youths postural asymmetries. Then, sports practitioners might concern about strength levels between the different muscular groups intending to minimize the mechanical and physiological stress. The medical doctors may analyse the soccer players postural asymmetries and recommend or not the sports practice. If not, physiotherapists may improve postural control and range of movement if limited. The personal trainers may target their practice to increase the muscular strength, avoiding imbalances and minimizing the postural asymmetries mechanical and physiological stress.

CONCLUSION

Postural asymmetries magnitude tend to change across competitive levels. Significant differences were observed in the different groups. Biomechanics inaccuracies, asymmetric growth, repeatability of specific soccer gestures and new demands in soccer competitive levels transition, can be some of explained factors for the identified asymmetries.

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